10-056-958

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,731,180 B1
DATED : May 4, 2004
INVENTOR(S) : Roger L. Clark, Joseph V. Adler and Jacob M. Li

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Replace title page with the following title page
Delete informal drawings, Figs. 1-7, insert the following formal drawings Figs. 1-7

Signed and Sealed this

Ninth Day of November, 2004

Jon W. Dudas

JON W. DUDAS
Director of the United States Patent and Trademark Office

(12) **United States Patent**
Clark et al.

(10) **Patent No.: US 6,731,180 B1**
(45) **Date of Patent: *May 4, 2004**

(54) **EVACUATED HYBRID OVENIZED OSCILLATOR**

(75) Inventors: **Roger L. Clark**, Windham, NH (US); **Joseph V. Adler**, New Milford, CT (US); **Jacob M. Li**, Danbury, CT (US)

(73) Assignee: **Deleware Capital Formation Inc.**, Wilmington, DE (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: 10/056,958

(22) Filed: Oct. 22, 2001

Related U.S. Application Data

(60) Provisional application No. 60/242,103, filed on Oct. 20, 2000.

(51) **Int. Cl.**[7] **H03B 5/32**; H03L 7/00

(52) **U.S. Cl.** **331/176**; 331/68; 331/69; 331/158; 310/341; 310/343; 310/344

(58) **Field of Search** 310/343, 346, 310/340, 341, 342, 344; 331/68, 69, 158, 176

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Primary Examiner—Arnold M. Kinkead
(74) *Attorney, Agent, or Firm*—Maine & Asmus

(57) **ABSTRACT**

The present invention is for a thermally controlled package for oscillators, particularly evacuated miniature surface acoustical wave oscillators (EMSO) devices. In a preferred embodiment the surface acoustical wave device is bonded directly to a heated substrate. The package is evacuated to improve temperature characteristics. A temperature heater, sensor, and control controller are utilized to maintain the internal package temperature above ambient. In one embodiment there is an additional substrate layer that house components that are not sensitive to temperature with interconnects electrically connecting the heated substrate and the additional substrates.

21 Claims, 7 Drawing Sheets

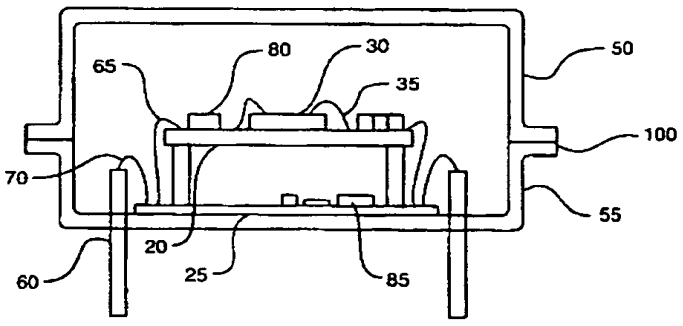

FIG. 1

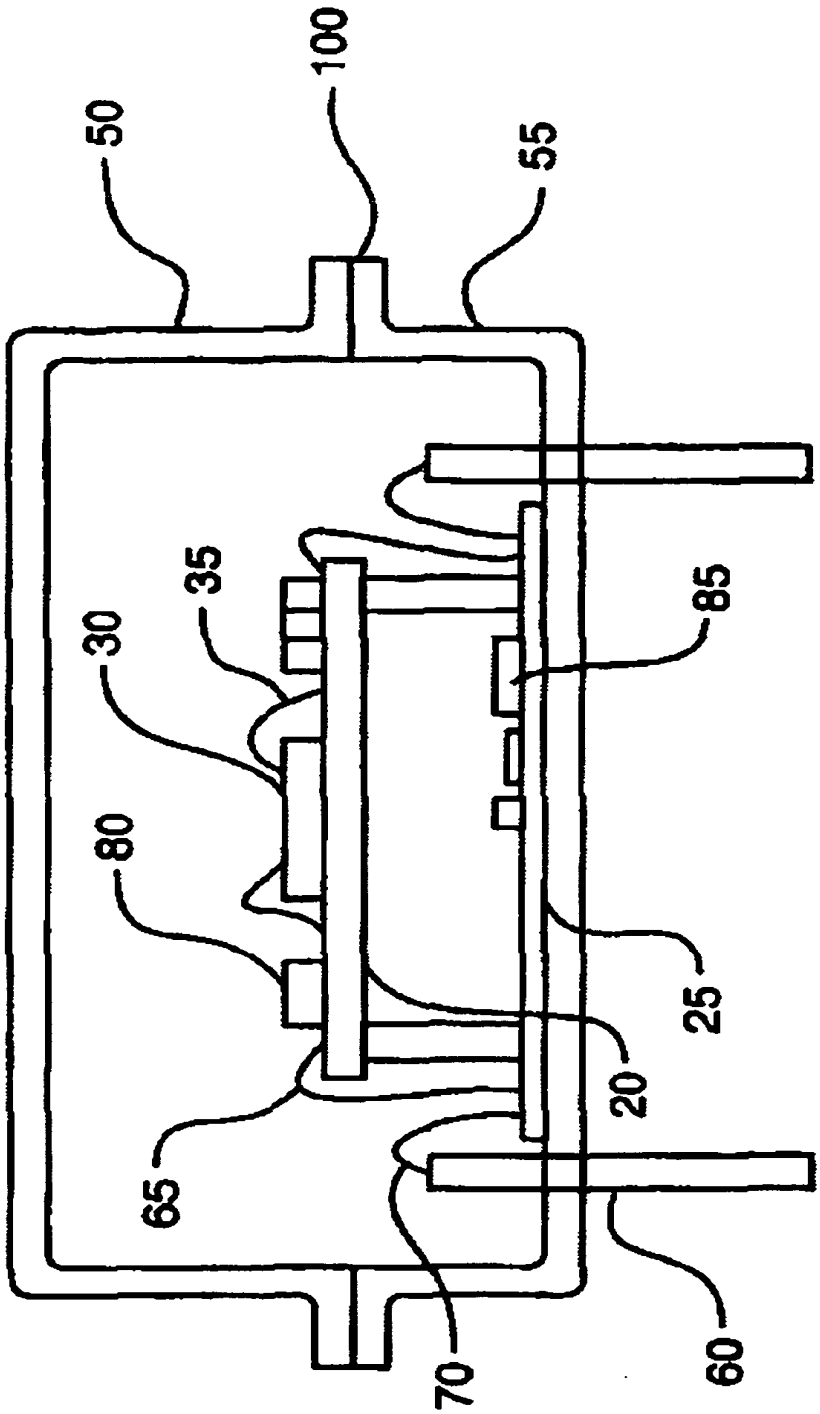

FIG. 1

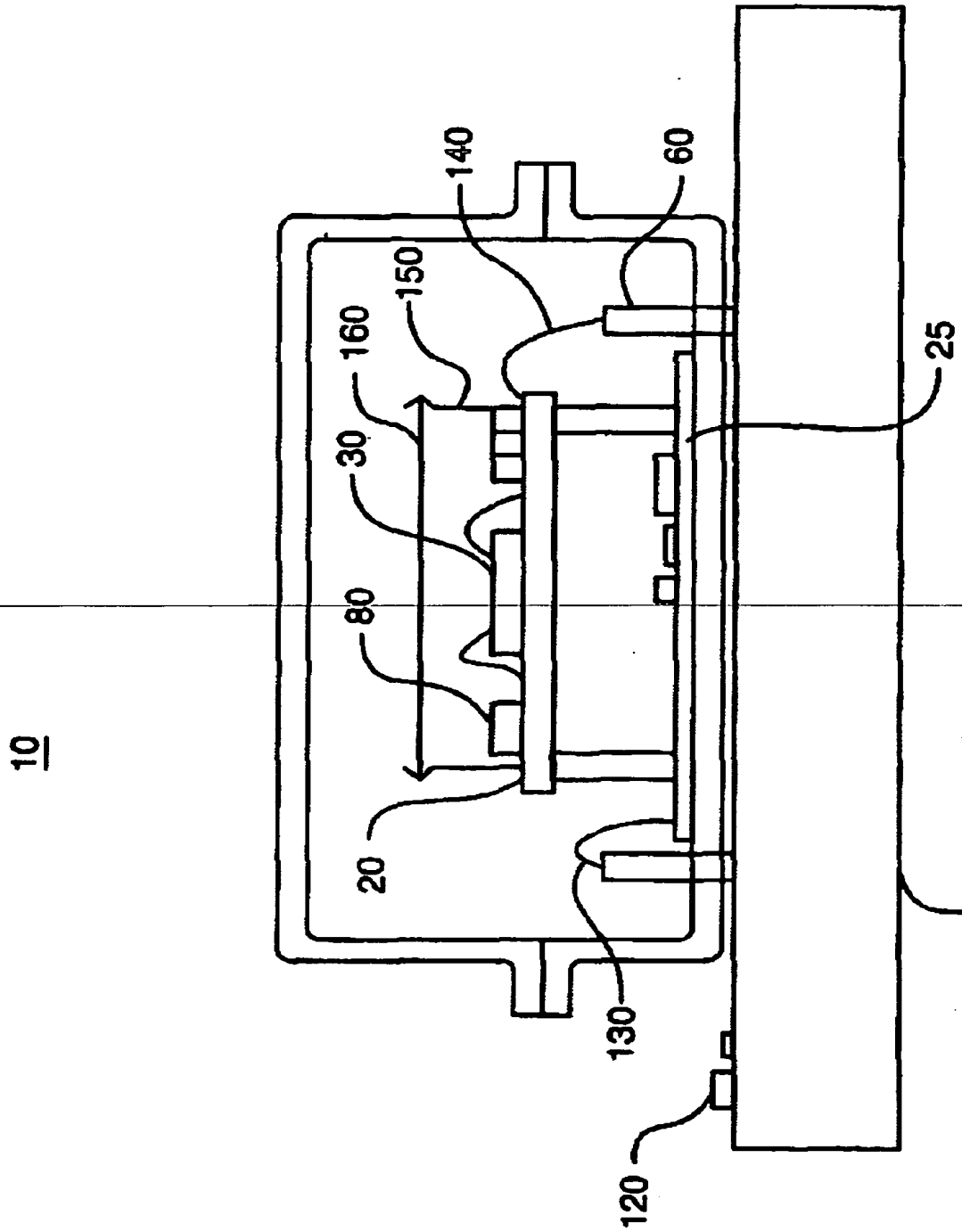

FIG. 2

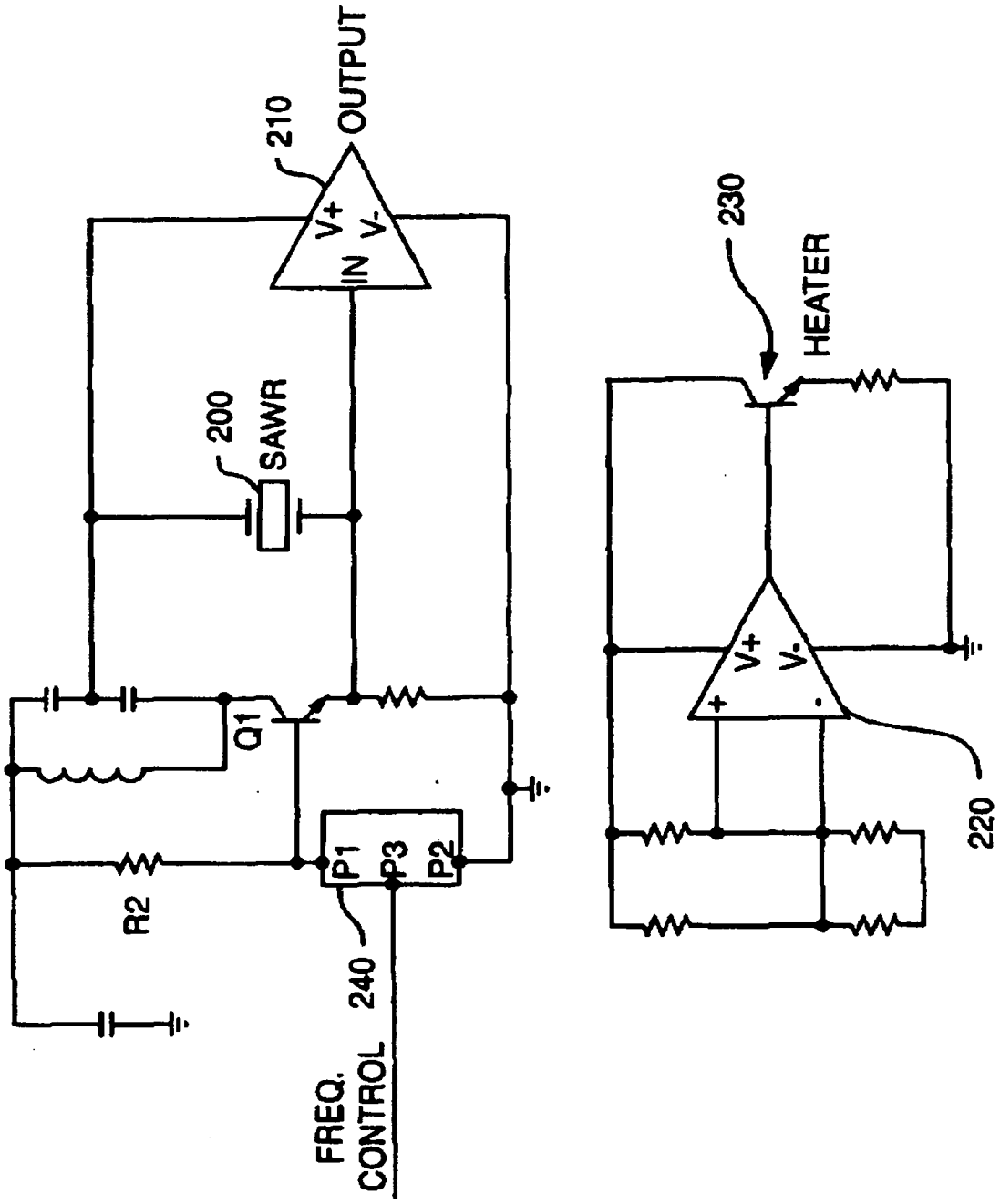
OUTPUT
210
V+
V-
IN
200
SAWR
Q1
R2
P1
P3
P2
240
FREQ.
CONTROL
230
HEATER
V+
V-
220

FIG. 3

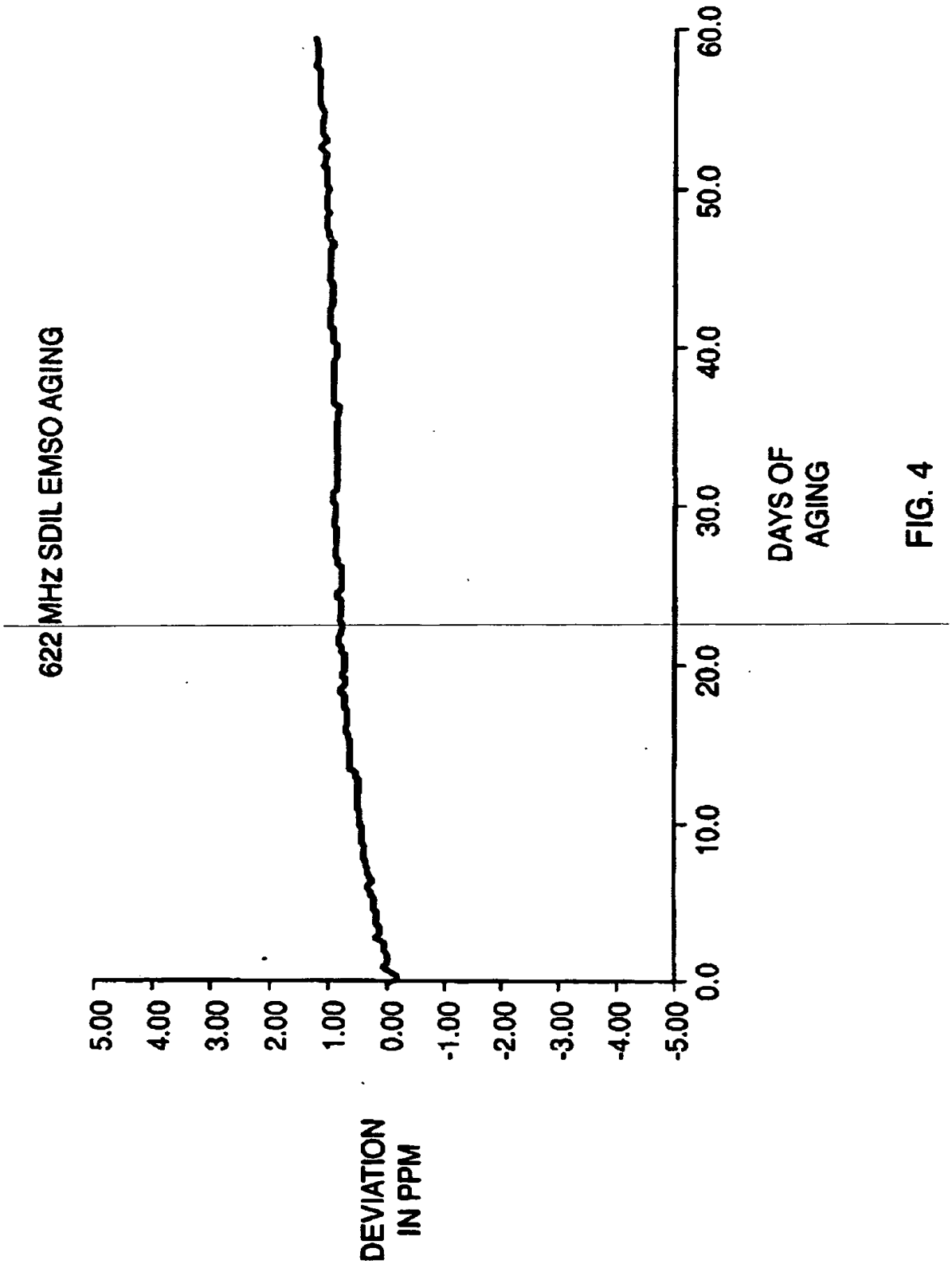
622 MHz SDIL EMSO AGING
DEVIATION IN PPM
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
0.0
10.0
20.0
30.0
40.0
50.0
60.0
DAYS OF AGING

FIG. 4

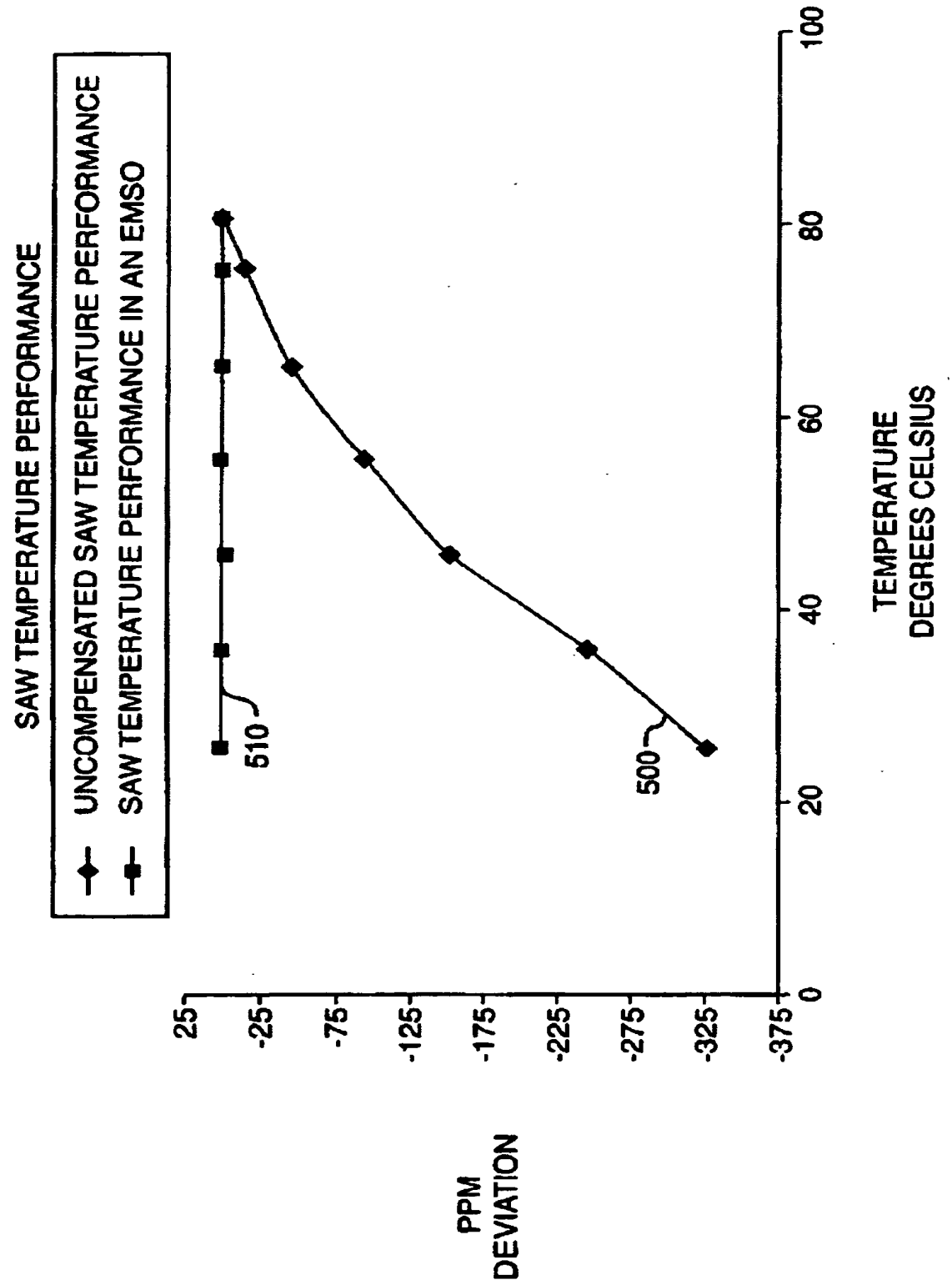
SAW TEMPERATURE PERFORMANCE
UNCOMPENSATED SAW TEMPERATURE PERFORMANCE
SAW TEMPERATURE PERFORMANCE IN AN EMSO
510
500
25
-25
-75
-125
-175
-225
-275
-325
-375
PPM DEVIATION
0
20
40
60
80
100
TEMPERATURE DEGREES CELSIUS

FIG. 5

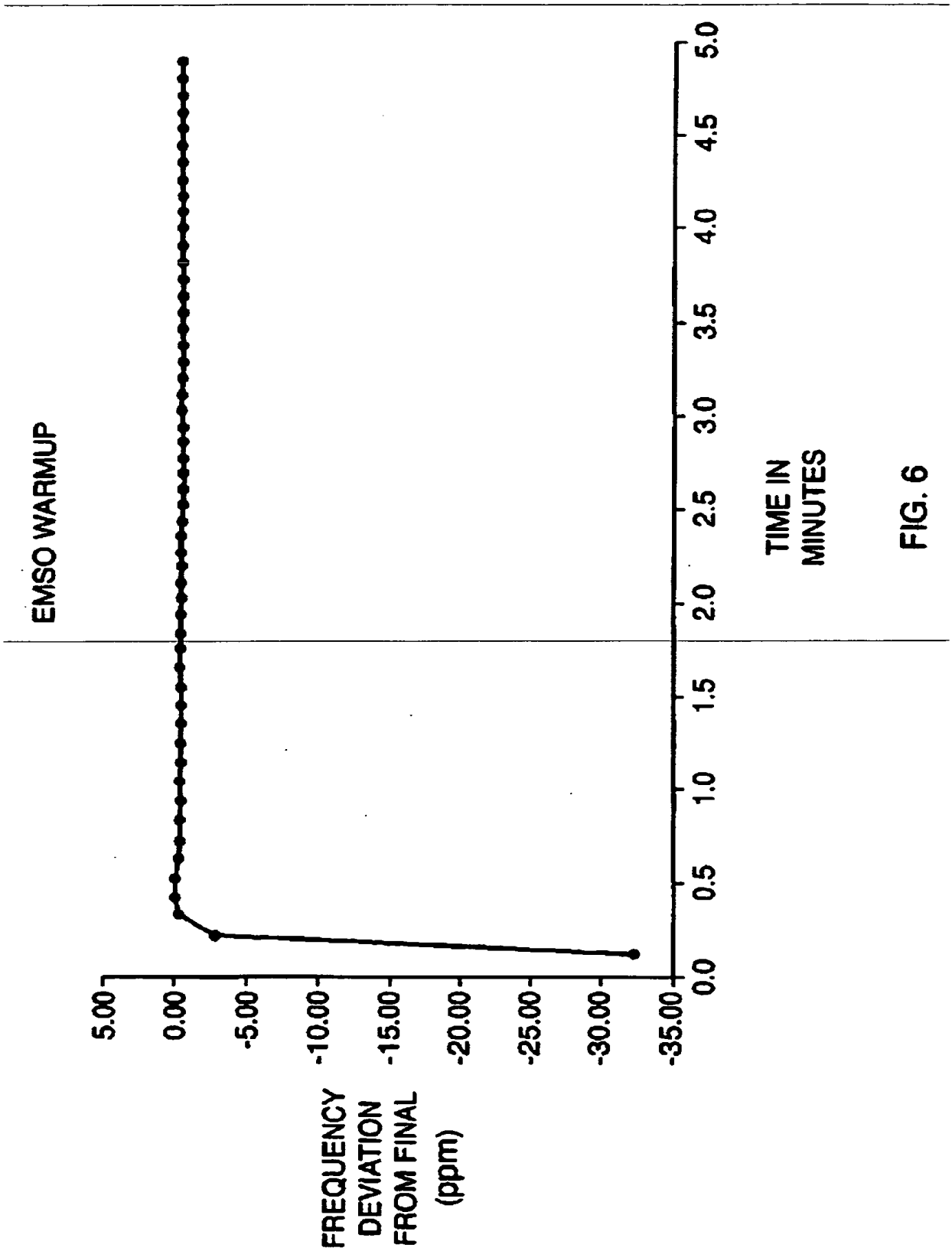
EMSO WARMUP
TIME IN MINUTES
FREQUENCY DEVIATION FROM FINAL (ppm)
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

FIG. 6

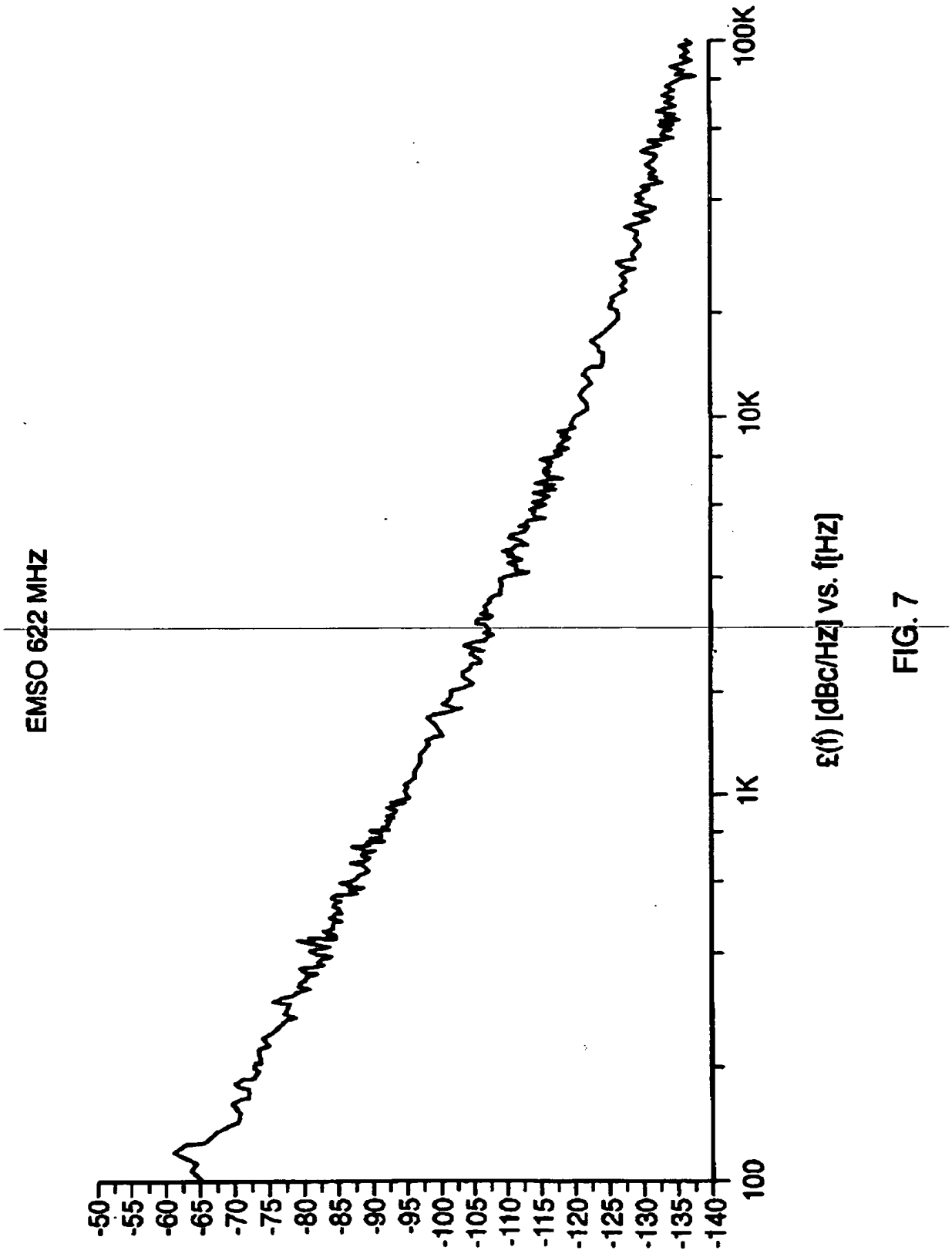
EMSO 622 MHz
£(f) [dBc/HZ] vs. f[HZ]
100K
10K
1K
100
-50
-55
-60
-65
-70
-75
-80
-85
-90
-95
-100
-105
-110
-115
-120
-125
-130
-135
-140

FIG. 7